QUARTERLY STATUS REPORT NO. 33

June 9, 1973 - September 30, 1973

Contract Number NASW-2512

Southeastern State College

Durant, Oklahoma

Leon Hibbs

President

Chairman of TUSC

C. Henry Gold

Director of TUSC

TECHNOLOGY USE STUDIES CENTER

SOUTHEASTERN STATE COLLEGE

DURANT, OKLAHOMA 74701

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By
C. Henry Gold
A. M. Moore
Bill Dodd
Velma Dittmar

October 1973

TECHNOLOGY USE STUDIES CENTER

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PREFACE

Although this is TUSC's thirty-third quarterly status report, the actual time period covered herein is April 1, 1973 - September 30, 1973 (six months). Information pertinent to the April 1, 1973 - June 8, 1973 time period was included in the TUSC 1973 Annual Report.

Included in this report is statistical information that concerns the previous quarter and the July 1, 1973 - September 30, 1973 quarter.

The above situation relates to the contract closing/award dates; i.e., the 1973 contract termination date was June 8, 1973; and the current contract period of performance is June 9, 1973 through May 31, 1974. Article III of this contract establishes reporting requirements and subparagraph B provides for submission to the TUSC first Quarterly Status Report on or before October 15, 1973.

The TUSC personnel involved in providing input information for this report were: A. M. Moore, Senior Industrial Specialist; Bill Dodd, Industrial Specialist; Brent Martin and Tommy Marvell, Information Retrieval Assistants; Veleta Coleman, Laura Elix, Brenda Futrell, and Barbara Miles, Clerical Assistants; Velma Dittmar, Administrative Assistant; and C. Henry Gold, Director.

C. Henry Gold

October 1973

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SUMMARY

This is the first Quarterly Status Report by TUSC as provided in Article III of NASA Contract NASW-2512.

The reporting of TUSC activities, functions, services, etc., in this report involves the overlapping of two time-periods (two quarters), since TUSC's contract date of performance does not coincide with the calendar year. For example, TUSC activities/ services through June 8, 1973, were reported in the 1973 Annual Report. Therefore, this report "picks up" the remaining 22 days in June, in addition to July 1, 1973 - September 30, 1973 activities.

As a routine practice, TUSC has included its search accomplishments in the last Quarterly Status Report; i.e., annual search accomplishments as compared with that of prior years--that information follows:

FY 1970 - 76 searches completed
FY 1971 - 128 searches completed
FY 1972 - 227 searches completed
FY 1973 - 216 searches completed

Although the total number of searches completed, during the past year, indicates a slight decline, the quarterly average is 54 searches. This figure indicates a higher accomplishment than TUSC's expectation. Based upon available manpower, finances, manual search techniques, etc., TUSC has estimated that 50 searches per quarter represent our capability saturation point;

therefore, the 216 search accomplishment by TUSC personnel, during the past year, is viewed optimistically with regard to TU efforts.

Two very significant events occurred during the contract performance that could easily have affected TUSC's TU efforts and the slight decline. The heating unit in the building where TUSC is located was not operative until December 11, 1972, and the Hearings of the Select Committee on Small Business. It is reasonable to conjecture that the TU efforts of the SBA were interrupted while preparing to testify for the June meeting of the Subcommittee Hearings. For sometime before the date of the Hearings, TUSC did not receive requests for information from the SBA due to an arbitrary decision to terminate TU services to SBA clients.

Insofar as TUSC is concerned, the highlight of this report is the successful adaptation of the Stair tree-cutting device (Transfer 40) for industrial use.

SPECIFIC REPORT RELATING TO STATEMENT
OF WORK IN NASW-2512

TUSC is sponsored by NASA through a contract relationship. Article I sets forth TUSC's Program of Work and Article VIII sets forth TUSC's reporting requirements. Other information pertinent to this report is indexed on page iv.

Dissemination and Assistance

Transfers

Transfer 40 --This transfer, otherwise known as the Stair Tree Cutting Device, was first reported in TUSC's Quarterly Status Report #18. Mr. Stair has never lost confidence in his invention--his judgment and confidence were correct because he now has a buyer for the right to manufacture and market the machine. Mr. Stair believes that the first production "run" will be to produce an industrial version of his tree-cutting device; then later a smaller unit will be produced suitable for ranch and/or farm use for the clearing of timber, stumps, brush, etc. A newspaper article telling the story about this transfer is included in Appendix B.

Transfer 162--This transfer concerns the "fish farm" at Whitewright, Texas. The facility that was built is ideal for "indoor" raising/ harvesting of fish; however, this story appears to be one with a sad ending. Apparently the well water (only source of water) simply is of such poor quality that it is not

suitable for supporting fish culture. This is the conclusion of the prospective buyer of the enterprise. Thus, it appears that transfer of information is about all the "mileage" TUSC will be able to report on this item. For several months, the project appeared to be a likely candidate for an economic boost to the area.

Searches and/or Assistance

Search 979--This request concerns information about the Occupational Safety and Health Act (OSHA). In recent months, TUSC has experienced more "repeats" on this subject than any one area. The September issue of Food Engineering published an OSHA Checklist which was based on the publication OSHA CHECK LIST prepared by the Warner Insurance Loss Prevention Department, Chicago. It is one of the best instruments that we have seen for an overall check of safety hazards that can be easily overlooked. A copy of this Checklist is included in Appendix C.

Search 981--For obvious reasons, TUSC is unable to report on the productivity of this search; the individual has an interest in recovering various precious metals; i.e., gold, silver, and platinum, from electronic and associated equipment. The market price in gold alone could make such a project worthwhile--assuming that large quantities of scrap electronic material was or is available. In terms of reference material, the search was quite productive.

Search 982--Information retrieval was directed toward information about "head up instrument display." This system is being used with a high level of success in driver education at the Oklahoma State School for the Deaf, Sulphur.

Search 1005--This was another search in support of the SSC Biology project conerning the use of the natural ecology system to purify water. It is a College/Community project involving a plan to reclaim sewage or polluted water and use earthen lagoons in the purification process. Fish will be grown in one of the lagoons, and this search was an attempt to find research data on the use of sound to immobilize fish for "harvesting." Searches 893, 898, and 909, as reported in QSR #32, also relate to the project.

The record of Searches 942-976 are included in TUSC's 1973 Annual Report; Searches 977-1045 are included in this report.

Assistance--The same student who was instrumental in the construction of SSC's radio telescope (ref. Transfer 163, QSR #29) is now working on a device described in NASA Tech Brief 73-10185, Electromatic Wave Energy Converter. In response to our inquiry, the Goddard Space Flight Center was very helpful in providing additional information about the device. The student is now in the process of constructing the device, and he has expressed appreciation for the exchange of NASA information.

For study purposes, TUSC either reproduced or made available data bank information in the Science, Oil and Gas Journal, Water Pollution Journal publications, and various microfiche copies of NASA reports. TUSC has a record of sixteen instances of such assistance during this reporting period.

Information about Indian population in Bryan County was made available to the Assistant Superintendent of the Durant Public School system.

Aviation students continue to be frequent users of data bank information--such assistance varies from use of magazine articles to the use of NASA reports; i.e., Special Publications, Contractor Reports, Tech Briefs, Technical Translations, etc. The Aviation Week and Space Technology magazine is a favorite reading reference for Aviation students.

The basic topic under discussion during the Select Committee Hearing on Small Business was Technology Utilization--TUSC is proud to have had the opportunity to participate in the Hearing and to provide substantive data. The TUSC Director, Dr. C. Henry Gold, and the Senior Industrial Specialist, Mr. A. M. Moore, participated in the Hearing. Based on testimony given, as reported in the Congressional Report of June 5, 1973, it appears that a unanimous voice was presented to the Congressional Committee favoring TU services to be continued for small firms. TUSC looks forward to a continuing favorable interchange of information with the SBA.

TUSC has undertaken a new and different "task" toward Technology Utilization by dissemination of aviation/aerospace information. By no-cost, letter agreement, NASA approved the publication of a General Aviation News Letter. In conversation with Mr. Roger L. Winblade, Chief of NASA's General Aviation Technology Office, it was determined that no duplication of effort would arise. Information disseminated by the NASA office is on an engineering level and probably is not appropriate for the majority membership of the National Business Aviation Association and/or others interested in General Aviation. In other words, the TUSC's publication is

primarily aimed at non-engineer persons who have an interest in research and development programs/advancements that concern aviation but written in non-engineering language.

Volume I, Number 1, of the TUSC General Aviation News Letter has been published--a copy of it is included as Appendix D. TUSC is estimating a capability of publishing the News Letter approximately one each month.

Searches Processed During July, August, September

Search Number	Subject of Search
977	Light Scattering Photometers; Light Scattering Chambers; and Photometers in General, State-of-the-art
978	Information on Computer Programmed Instruction
979	Information on OSHA
980	State-of-the-art on Optical Light Sources
981	Recovery of Gold, Silver, and Platinum from Electronic and Associated Equipment
982	Head-Up Displays on Windshields--How Are the Images or Lights Projected upon the Windshield?
983	Energy Fluxes or Temperatures Required to Cause Skin Burns to Humans or Animals
984	Source of Energy for Skylab
985	Is there a Relationship Between the Difficulty of the Subject Being Taught and the Effectiveness of "Teaching Machines"? (Programmed Teaching, Computer Teaching)
986	Sheer Line Characteristics in Low Speed Aerodynamics
987	Circuit Board Electrical Insulation, Wire Characteristics and Conductors
988	Corrosion of ASTM A-105 Carbon Steel or Other Carbon Steels in Underseas Environments
989	Pollution Problems Associated with Galvanizing Plants

Search Number	Subject of Search
990	Theory, Design and Operation of Electrostatic Precipitators
991	Devices for Filtering Air in Homes, Hotel Rooms and Small Indoor Areas
992	Rubber and Metal Seals and Sealing Techniques, Especially for Use under Seawater.
993	Use of CO_2 as Refrigerant for Portable Type Regrigerators
994	Water Purification Plants and Sewage Treatment Plants for Small Cities (10,000 or less) or Subdivisions
995	Best Memory Device for Recording the Fluctuations of a Galvanometer for a 2-Hour Period (One-Inch Pipe)
996	Light Transducers that Are: A) Photomultiplier Tube Replacements, B) Linear Devices, C) Solid State, D) Response to Complete Visible Light Spectrum, E) Sensitive in Microlumen Areas, and F) Cheap
997	State-of-the-art on Kiln Drying Lumber and Burning Sawmill Waste (EPA Standards)
998	Electrical Muscle Stimulators, Both External and Implanted
999	Types of Smoke and Fire Sensors
1000	Analytical Methods and Apparatus Used for Measuring NO_2 in Air
1001	Analytical Methods and Apparatus Used in Measuring SO_2 in Air
1002	Gasoline Vapor Recycling/Recovery Methods at Point of Tank Truck Delivery to Filling Station Storage Tanks
1003	Audio Amplifiers and Preamplifiers
1004	Select Population and Economic Information on SODA Counties
1005	Use of Sound to Stun or Immobilize Fish
1006	Color of Light Best Seen in Sunlight amd Electroluminescent Methods Used to Produce the Best Color for Sunlight Viewing
1007	Quartz Crystals, state-of-the-art on growth of
1008	Infrared Surveillance Technology

Search Number	Subject of Search
1009	Use of Earth Satellite Photography for Interpreting Geological Structures and Anomalies
1010	Source/s of Polyvinyl Choride Compound in Either Virgin or Reground Form
1011	Automatic Drafting Systems for Use with Stero Plotter for Cartographic Drafting
1012	Information on Theory, Design, and Operation of Electrostatic Precipitators
1013	Urban Surveys from Air/Space Photography--City and Utility Records
1014	Source of LM 3900 Integrated Circuits
1015	Information on Thermistors: A) Accuracy of Thermistors, B) Long-term Stability, and C) Accuracy at Different Temperatures
1016	A) Information Available to Measure Mass Concentration of Airborne Particulates in the Atmosphere (gm/cu meter air) and B) Information on Particle Size Distribution in Airborne Particles
1017	Airport Electronic Security Devices
1018	A) Noise Immunity System to Be Used in Security Systems which Will Not Interfere with Normal Telephone Lines or Two-Way Radios and B) Noise Immunity of Digital System with Normal Communications
1019	Design and Operation of Flame Photometer to Define Particle Size and Concentration of Particles
1020	A) Electro-optical Ceramics (Lead-Lanthanum Zirconate-Titanate) PLZT, B) Photo-conductive Film or Other Coating for PLZT, and C) Who Are Commercial Suppliers?
1021	Firm Wants a Colored Paint Type Product for Use as a Coating on Al-1100 from 1/16" to 1/8" Thick. Must Be Durable for Electronics Case and Method of Application Must Be Simple and Inexpensive
1022	A) High Speed Photography in the Nature of Microsecond Capability and B) Photographing Lightening
1023	General Information on Skylab
1024	Fluid Flow Measurement

Search Number	Subject of Search
1025	Water Purification and Sewage Treatment Plants for Small Cities
1026	Energy Sources
1027	Nondestruction, State-of-the-art Technique
1028	Low Level Ionized Radiation--Effect on the Human Body
1029	Converting Photomultiplier Tube to Solid State and Coupling of Optics
1030	High Speed Air Valve for Use on Color Sorting Machine
1031	Water Pollution and Energy Usage
1032	Influence of Research Personnel on the Effectiveness of Math Teaching in Public Schools
1033	Imposing a High Frequency Audio Signal on a Long Wire so That the Wire Will Vibrate at the Same Frequency as the Imposed Audio Signal
1034	General Information on Electronics
1035	Powder Metallurgy and Machine Shop Measurement
1036	Task Scheduling for Multiprocessor
1037	Microfilm Readers
1038	Hydrostatic Testing of Pipe--Measuring the Pressure It Will Stand and How the Thickness of the Pipe Wall Can Be Determined
1039	Urethane Foams Manufacturing Methods
1040	Nondestructive Testing of Drill Pipe--Electronic Means
1041	Use of Hydrogen for General Energy Purposes
1042	Information Concerning Time of Moon Rise and Moon Set
1043	State-of-the-art in Bourdon Tubes or Substitutes for Them
1044	Task (or job) Scheduling for Optimal Computer Usage
1045	A) State-of-the-art in Cable Television Transmission and Wire--Need Index of Tech Briefs Dealing with CATV (Community Antenna TV) and B) Broadband TV Cable Communications--Coaxial Cable

Faculty Information Service

As mentioned in previous Quarterly Status Reports during the July-September time period, this is the time of the year that coincides with normal summer vacation time. Thus campus activities across the land are at a low ebb. Last year 12 searches were accomplished in support of faculty/student requests--16 searches were accomplished in 1973 (the total number of searches completed during the quarter were 56, as compared to 40 searches in the same quarter one year ago).

TUSC has been in a favorable position to provide information to the Biology Department in support of the previously mentioned college/community joint project (page 3) for developing a water purification system using nature's ecology methods.

The College speech debators have requested TUSC's assistance in providing information on subjects of national importance--energy; i.e., conversion of energy, nuclear reactors, solar energy, and conversion of energy. Another similar student request, Search 1041, has to do with "use of hydrogen as a fuel for mundane usage in automobiles, aircraft, and for energy purposes." It was a fruitful search in that eight NASA abstracts were forwarded as well as five other reports and/or related magazine articles.

We are reporting only one search request (Search 1047) that concerns the Harrier Aircraft--the aircraft performed as part of the "Air Show" at the opening of the Greater Southwest Airport. The airplane created much interest among aviation students--we do not have an exact count but several students used the Center as a source of information about the Harrier.

The University of Oklahoma Research Institute requested information on energy fluxes or temperatures required to cause skin burns to people or animals--25 NASA reports were retrieved and forwarded on this subject.

Cooperation with Other Agencies

The Center's contact and cooperation with other agencies during the July-September quarter primarily involved interactions with the SBA. As already mentioned (page 4), TUSC personnel participated in Hearings of the Select Committee on Small Business. Considerable interchange of information, written and verbal (telephone), was made in preparation for the Hearing. Searches completed for the SBA numbered 36.

TUSC accomplished a very comprehensive search for the Souther Oklahoma Development Association that concerned population and economic information. Our primary reference was the 1970 census data.

General Center Functions

From the standpoint of Technology Utilization, the most important function of the Center, during this reporting period, concerns TUSC's participation in the Congressional Hearing of the Select Committee on Small Business previously mentioned herein (page 4). Also, TUSC expects the General Aviation News Letter to become an effective TU vehicle.

The NASA/TUSC Technology Utilization story was presented to Durant High School students who visited the Center on class field

trips--both Mr. A. M. Moore and Mr. Bill Dodd were utilized to explain the purpose of the Center and information that is available through the NASA data bank.

A College faculty member attended the annual meeting of the University Aviation Association held at Appleton, Wisconsin. This occasion was utilized, in part, as a forum to determine the level of interest which might reasonably be expected to the TUSC General Aviation News Letter from the general membership of the organization. As expected, a highly favorable reaction to the idea was the response. In fact, TUSC received several letters of encouragement to proceed with the News Letter. One letter, of particular encouragement, was received from the Aviation Education Consultant for the Cessna Aircraft Company. (A copy of this letter is included in Appendix B.) Furthermore, the Texas Aeronautics Commission has provided TUSC with a favorable response to our first issue in which four NASA reports mentioned in the News Letter have been ordered. Thus, this vehicle at an early stage of development is proving to be an effective method for technology utilization/dissemination.

The TUSC Director, Dr. Gold, attended a meeting of the Executive Committee of the Chickasaw Area Library Learning Center in Ardmore, Oklahoma. This Center provides additional opportunities for Chickasaw Indians not only to maintain a record of their culture but also provides a learning center.

Staff Personnel

Beginning with the Fall Semester, both Dr. Gold and Mr. Dodd are serving in academic positions in addition to serving as TUSC Director and Industrial Specialist respectively. Dr. Gold serves as Dean of the School of Business and Industry and Mr. Dodd serves as a part-time Aviation Ground School instructor.

No other changes in staff personnel have been made.

APPENDIX A

SUMMARY OF CHARACTERISTICS OF TUSC TECHNICAL SEARCHES

TABLE 1

SUMMARY CHARACTERISTICS OF TUSC TECHNICAL SEARCHES BY CATEGORIES,

Search Number	Abstracts Sent	Reports Ordered	SIC Code	STAR - IAA Categories																																
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
977	3	--	IO													1																	2				
978	1	--	IS								1																										
979	--	--	IO																																		
980	--	--	IO								(137 Pages of IAA and STAR Indexes)																										
981	16	--	IO						3	1								3		2	2						1		4								
982	4	--	36	2	1												1																				
983	27	--	IS				18	2									1		6																		
984	--	--	IS																																		
985	20	2	36					9	2		4						1		1				2														1
986	17	--	36	8	2	1																											6				
987	25	5	36						1			15	2				1	4			1	1															
988	23	--	IO						1									2		17	2	1															
989	--	--	IO																																		
990	16	--	IO						1	1			1				4	7								1	1										
991	36	--	IO		1		3	5						8	4	1	2	4	1		1				3					1		1				1

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				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
992	73	--	IO														7	55		1	9				1												
993	--	--	IO																																		
994	20	4	IO				2								1	13												1							1	2
995	13	--	IO				1	1		1	1	2					6										1									
996	23	--	IO			6	1				1	1	1			1	5									1	1		5							
997	--	--	IF																																	
998	38	8	IO				21	16									1																			
999	21	--	IO							1		1				5	11	1							1				1								
1000	31	--	IO				2	2	3	3					1	8	1	1		1			3		1					1	2				1	1
1001	36	2	IO				2	1	10			1		1		6	6	2	2				4							1						
1002	6	--	IO											1																1	1				2	1
1003	--	--	IS																																	
1004	--	--	IT																																	
1005	9	--	IF	1			1						1	3		1					2															
1006	23	--	IF				3	9	1			1					3	4				1		1												

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1007	60	12	IO				2		2			20	1			9	2				1				1		1	2	17	2							
1008	37	--	IO		1		1			6		1				4	14	1				2		3	1	1					1					1
1009	27	1	IO													16	8						1	1								1				
1010	--	--	IO																																		
1011	43	--	IO				2	5			24					6	3	1							1											1
1012	16	--	IO						1	1			1				3	7								1	1									1
1013	36	--	IO							1	1					14	18			1						1										
1014	--	--	IO																																		
1015	54	3	IO				1					5	2			5	30	3	1				3	1						1					1	1
1016	64	--	IO				4	2	9	1				1		14	13	2	2				5	8	1											2
1017	9	--	IO										5		1																					3
1018	11	--	IO								7	1	2													1										
1019	13	5	IO						5	1				1	2	1	2		1																	
1020	14	--	IO									1								2	10					1										
1021	5	--	IO																	1	4															

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1022	38	--	IS	1						1						2	28	1	3									1								1	
1023	145	--	IF	4	2	1	6	5	5	6	6	5	9	2	6	5	3	9	5	10	13	5	7	8	8	5	10									
1024	22	--	IO	2		2								2	3		8								1	1					3					
1025	31	2	IF	1			3	5		1					1	13		1										2				1				3
1026	54	--	IS	2		4	1		2		1	2	1		1	5	1	3	1						6		3	3		1	4	2	3			2	6
1027	--	--	IF																																	
1028	9	6	IS				5	2									1		1																	
1029	21	--	IO			1	1					5	2	1			6	1								2	1		1							
1030	3	--	IO			2												1																		
1031	1	1	IS																									1								
1032	15	--	IF					13	1						1																					
1033	9	--	IO					1																		4	1		1					1	1	
1034	--	--	IF																																	
1035	--	--	IF																																	
1036	--	--	IF																																	

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SUMMARY CHARACTERISTICS OF TUSC TECHNICAL SEARCHES BY CATEGORIES,

Search Number	Abstracts Sent	Reports Ordered	SIC Code	STAR - IAA Categories																																
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1037	--	1	IO																																	
1038	9	--	IO									1					1	2	1						2										2		
1039	47	--	IO	1	1		3		1	6		2		1		3	3		1		2	11			1	1			8	1						1
1040	37	--	IO		1							2	2	1			6	11	1	2	1				3	1	1				1			1	3		
1041	9	--	IS						1																1	3				1	3					
1042	--	--	IF																																	
1043	17	--	IO									1			1	1	13	1																		
1044	61	3	IS						1	3	45	2	2			1	1						2		2	2										
TOTAL	139	8	55	22	9	17	83	78	50	34	91	69	32	22	22	135	214	127	27	37	48	21	27	22	34	26	22	10	37	9	16	2	8	7	6	10	24

TABLE 2

SUMMARY CHARACTERISTICS OF TUSC TECHNICAL SEARCHES BY DATA SOURCE

Search Number	Federal R & D Reports	Library of Congress	McGraw - Hill	TUSC Library	SSC Library	Tech Briefs	Contractor Reports	Technical Notes	Special Publications	Aerospace Technology	American Aviation	Aviation Week	Business Week	Electronics	Engineering News Record	Food Engineering	Forest Industries	Industrial Research	Instruments & Control Systems	International Science & Tech.	Iron Age	Materials Engineering	Modern Plastics	Oil & Gas Journal	Research & Development	Science	Technology Week	Welding Journal	Sales Management	Business Automation	Thomas Register	AD Abstracts	WPCF	Heating/Piping Air Conditioning	Products Finishing	Combustion
977						38			(48 Pages of IAA Subject Indexes)																											
978																																				
979				4																														1		
980						45																														
981																																				
982									1																											
983																																				
984									2																											
985																																				
986																																				
987						5																														
988																																				
989																																				1
990																																				2
991																																				

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Search Number	Federal R & D Reports	Library of Congress	McGraw - Hill	TUSC Library	SSC Library	Tech Briefs	Contractor Reports	Technical Notes	Special Publications	Aerospace Technology	American Aviation	Aviation Week	Business Week	Electronics	Engineering News Record	Food Engineering	Forest Industries	Industrial Research	Instruments & Control Systems	International Science & Tech.	Iron Age	Materials Engineering	Modern Plastics	Oil & Gas Journal	Research & Development	Science	Technology Week	Welding Journal	Sales Management	Business Automation	Thomas Register	AD Abstracts	WPCF	Heating/Piping Air Conditioning	Products Finishing	Combustion
992																																				
993																																				
994						3																											31			2
995				1					3																											
996																																				
997				6													17						1													
998																																				
999				1																																
1000						2																														
1001																																				
1002				1																				1												
1003				1																																
1004				1																									1							
1005																																				
1006																																				

TABLE 2

SUMMARY CHARACTERISTICS OF TUSC TECHNICAL SEARCHES BY DATA SOURCE

Search Number	Federal R & D Reports	Library of Congress	McGraw - Hill	TUSC Library	SSC Library	Tech Briefs	Contractor Reports	Technical Notes	Special Publications	Aerospace Technology	American Aviation	Aviation Week	Business Week	Electronics	Engineering News Record	Food Engineering	Forest Industries	Industrial Research	Instruments & Control Systems	International Science & Tech.	Iron Age	Materials Engineering	Modern Plastics	Oil & Gas Journal	Research & Development	Science	Technology Week	Welding Journal	Sales Management	Business Automation	Thomas Register	AD Abstracts	WPCF	Heating/Piping Air Conditioning	Products Finishing	Combustion
1007							1																												
1008						3																													
1009																																			
1010																						1													
1011						7																									3				
1012																																			2
1013																																			
1014																																			
1015																																			
1016																																			
1017																																			
1018																																			
1019					1																														
1020																														1			4		
1021																																			

TABLE 2

SUMMARY CHARACTERISTICS OF TUSC TECHNICAL SEARCHES BY DATA SOURCE

Search Number	Federal R & D Reports	Library of Congress	McGraw - Hill	TUSC Library	SSC Library	Tech Briefs	Contractor Reports	Technical Notes	Special Publications	Aerospace Technology	American Aviation	Aviation Week	Business Week	Electronics	Engineering News Record	Food Engineering	Forest Industries	Industrial Research	Instruments & Control Systems	International Science & Tech.	Iron Age	Materials Engineering	Modern Plastics	Oil & Gas Journal	Research & Development	Science	Technology Week	Welding Journal	Sales Management	Business Automation	Thomas Register	AD Abstracts	WPCF	Heating/Piping Air Conditioning	Products Finishing	Combustion
1022																																			
1023																																			
1024																																			
1025						2																										31			2
1026																																			
1027									1																										
1028																																			
1029																																			
1030						1			2																										
1031																																3			
1032																																			
1033																																			
1034						4																													
1035						3																													
1036					1																														

TABLE 2

SUMMARY CHARACTERISTICS OF TUSC TECHNICAL SEARCHES BY DATA SOURCE

Search Number	Federal R & D Reports	Library of Congress	McGraw - Hill	TUSC Library	SSC Library	Tech Briefs	Contractor Reports	Technical Notes	Special Publications	Aerospace Technology	American Aviation	Aviation Week	Business Week	Electronics	Engineering News Record	Food Engineering	Forest Industries	Industrial Research	Instruments & Control Systems	International Science & Tech.	Iron Age	Materials Engineering	Modern Plastics	Oil & Gas Journal	Research & Development	Science	Technology Week	Welding Journal	Sales Management	Business Automation	Thomas Register	AD Abstracts	WPCF	Heating/Piping Air Conditioning	Products Finishing	Combustion
1037																																1				
1038						4			6																											
1039	(33 Pages of STAR and IAA Indexes)																																			
1040						9																														
1041												1													3											
1042					1																															
1043																			2																	
1044																																				

APPENDIX B

SELECTED TRANSFER AND IMPACT REPORTS OF SIGNIFICANT IMPORTANCE

"Page missing from available version"

Pages 25 and 26

Missing

CABLE ADDRESS
CESSCO-WICHITA

Cessna® AIRCRAFT COMPANY

MARKETING DIVISION
COMMERCIAL AIRCRAFT

Wichita, Kansas 67201

August 13, 1973

Mr. A. M. Moore, Editor
The TUSC News
Technology Use Studies Center
Southeastern State College
Durant, OK 74701

Dear Mr. Moore:

During the meeting of the University Aviation Association last week in Wisconsin, Elizabeth Murphy acquainted all members in attendance with the TUSC Program.

First of all, I would like to be placed on the mailing list to receive this publication as well as expressing appreciation for your interest in this area.

At present, I am preparing an article concerning the benefits that general aviation has gleaned from the technological developments of the space programs. Since your center apparently has a substantial collection of materials relating to this topic, I would like to have an opportunity to visit with you in the near future. I can plan a trip to Durant at a time that would be convenient for you during the latter part of this month.

Thank you for your assistance. I am looking forward to visiting with you in the near future.

Sincerely yours,

CESSNA AIRCRAFT COMPANY

Phillip S. Woodruff
Aviation Education Consultant

PSW:cs
cc: Elizabeth Murphy

APPENDIX C

OSHA CHECKLIST

Checklists

OSHA Requirements

Here are safety hazards likely to be found in any plant. How does yours measure up?

		YES	NO
WALKING-WORKING SURFACES	Floors and other walking surfaces free of litter; aisles and passageways unobstructed? (1910.22)*	☐	☐
	Wet floor work areas provided with raised platforms or mats?	☐	☐
	Floor openings provided with railings and toe boards? (1910.23)	☐	☐
	Platforms and similar work areas with over 4 ft drop to next level provided with railing and toe boards?	☐	☐
	Stairways in good condition with standard railings provided?	☐	☐
	Portable wood and metal ladders adequate for purpose and in good condition? (1910.25-6)	☐	☐
	Fixed ladders adequate for purpose, in good condition and equipped with side rails or cages? (1910.27)	☐	☐
	Scaffolding? (check OSHA Standard) (1910.28)	☐	☐
	Mobile ladder stands (manual) and tower scaffolds? (check OSHA Standard) (1910.29)	☐	☐
	Dockboards (bridge plates) adequate for purpose, secured to prevent slipping; means provided to prevent car or truck movement when dock board in place? (1910.30)	☐	☐
MEANS OF EGRESS	(See Standard for number, location, protection of exits.) (1910.37)		
	All exits visible and unobstructed?	☐	☐
	Exits marked by readily visible sign—minimum 6 in. letters?	☐	☐
	Exit arrows provided where necessary? (1910.37q (5))	☐	☐
	Exit signs properly illuminated? (1910.37q (6))	☐	☐
PERSONAL PROTECTIVE EQUIPMENT	Are hard hats provided and worn where any danger of falling object? (1910.132-38)	☐	☐
	Are protective goggles or glasses provided and worn where any danger of flying particles or corrosive materials endangering employees?	☐	☐
	Are welder's goggles provided and worn?	☐	☐
	Are protective gloves, aprons, shields or other means provided against injury from cuts, corrosive liquids, chemicals?	☐	☐
	Are respirators provided for regular or emergency use—and worn—for protection from toxic dust, gas, vapors, fumes?	☐	☐
	Is all such protective equipment readily available and in good condition?	☐	☐
	Is it inspected regularly (at least once a month for emergency equipment)? Keep a record. (1910.34 (f) (2))	☐	☐
	Is rubber protective equipment (gloves, sleeves, etc.) provided for electrical workers—and worn? (1910.137)	☐	☐

*NOTE: All Section Numbers used herein are contained in the STANDARDS, copy of which is available from your OSHA office.

		YES	NO
OCCUPATIONAL HEALTH	Has carbon monoxide concentration been determined in warehouses and other closed areas where there is substantial emission of exhaust fumes from internal combustion engines (lift trucks, etc.)?	☐	☐
	Are ammonia masks provided for emergency use in refrigeration equipment room?	☐	☐
	Has a noise survey been made? (1910.95)	☐	☐
	If so, do any work areas exceed permissible level?	☐	☐
	If so, (see preceding question) are affected employees required to use protective devices (ear muffs or plugs) and are administrative or engineering controls being evaluated? (1910.95)	☐	☐
MEDICAL AND FIRST AID	Is there a hospital, clinic or infirmary for medical care within 8 minutes of workplace? (1910.151)	☐	☐
	If not, are one or more employees available during work hours who have been trained in first aid (Red Cross or equivalent)?	☐	☐
	Have first aid supplies been approved by a physician as adequate for workplace?	☐	☐
	If employees are exposed to corrosive materials, are quick flush facilities available? (1910.151 (c))	☐	☐
ELECTRICAL HAZARDS	Are you specifying compliance with the National Electrical Code (NEC) for all contract electrical work?	☐	☐
	Are your workplace electricians unfamiliar with the NEC?	☐	☐
	Is all electrical wiring and equipment located in production areas subject to combustible vapors or dusts (see 1910.322) approved for such use and installed in accordance with the NEC requirements for Hazardous Locations (Articles 500-503 of NEC)?	☐	☐
	Are any wires hung over nails, hooks, pipes, etc.?	☐	☐
	Is all conduit, BX Cable or other wiring properly attached to supports?	☐	☐
	Is conduit, BX Cable, etc., properly and tightly connected to junction or outlet boxes?	☐	☐
	Is there evidence of fraying of drop cords or portable cables where they enter lamp sockets, plugs, appliances, etc.?	☐	☐
	Are rubber cords kept free of oil, grease or chemicals?	☐	☐
	Are wires at splices and joints tight and insulated by tape or other means?	☐	☐
	Are electric appliances at fixed locations subject to moisture grounded?	☐	☐
	Are metallic cable and conduit systems properly grounded?	☐	☐
	Are portable electric tools and appliances grounded?	☐	☐
	Are ground connections clean and tight?	☐	☐
	Are fuses and circuit breakers of the right type and size for the load on each circuit?	☐	☐
	Do switches show evidence of overheating (result of high resistance contacts or overloads)?	☐	☐
	Are switches mounted in closed metal boxes?	☐	☐
	Are all metal boxes of the wiring system kept clean and tightly closed?	☐	☐
	Are motors kept clean and free of excessive grease, oil, etc.?	☐	☐
	Are motors properly maintained and provided with adequate overcurrent protection?	☐	☐
	Are starter, switch and other controls, as well as ground connections and motor leads in good condition?	☐	☐
	Are pilot lights used on all electrically heated devices (glue pots, soldering irons, etc.)?	☐	☐
	Has your entire electrical system been inspected in the last year by a competent electrician familiar with the requirements of the National Electrical Code?	☐	☐

		YES	NO
MATERIALS, HANDLING AND STORAGE	Where lift trucks are used are sufficient clearances maintained in aisles, at turns and overhead for safe passage? (Permanent aisles and passageways should be marked with floor stripes. Clearance warning signs should be posted where needed.) (1910.76)	☐	☐
	Are storage piles secure against collapse? (1910.76)	☐	☐
	Are storage areas free of loose material, rubbish, etc.?	☐	☐
	Is rollover and overhead protection provided on rider lift trucks?	☐	☐
	Is lift truck refueling done exclusively out of doors at a location free of ignition sources?	☐	☐
	Are only trained and authorized personnel allowed to operate lift trucks? (1910.178 (1))	☐	☐
	Have they been instructed in the safe operation of the equipment? (Written instructions are advised.) (1910.178 (m))	☐	☐
	Is equipment including motors cleaned regularly to prevent buildup of excess oil and grease?	☐	☐
	Are any overhead or gantry cranes in use? (If so, see 1910.179 for safety requirements.)	☐	☐
FIRE PROTECTION	Are portable fire extinguishers provided in adequate number and type? (1910.157 (b) (c))	☐	☐
	Are they inspected monthly for general condition, operability? (1910.157 (d) (2))	☐	☐
	Are they recharged regularly as required and properly tagged? (1910.157 (d) (2))	☐	☐
	Are they hydrostatically tested regularly as required and properly tagged?	☐	☐
	Are they mounted in readily accessible location with top not over 5 ft above floor (if 40 lb or less)?	☐	☐
	Are interior stand pipes and hose, where provided, inspected regularly?	☐	☐
	Are hose, valves, racks in good condition?	☐	☐
	Are they obstructed?	☐	☐
	Are fixed extinguishing systems (carbon dioxide, dry chemical)—where provided—inspected in accordance with manufacturers' instructions at least semi-annually? (1910.160-1)	☐	☐
	Are fire alarm systems—where provided—inspected and tested at least annually? (1910.163)	☐	☐
	Are plant employees periodically instructed in the use of extinguishers, small hose, fire alarm procedures?	☐	☐
	Are fire doors and shutters in good operating condition?	☐	☐
	Are all parts of the plant accessible to the public fire department?	☐	☐
	Is your local fire department well acquainted with your plant, location of specific hazards, etc.?	☐	☐
MACHINERY AND MACHINE GUARDING	Are all machines that expose operator or other employees to nip points, rotating parts or that produce flying chips, particles or sparks adequately guarded? (1910.212-219)	☐	☐
	Are power transmission belts and nip points adequately guarded? (See 1910.219 for exemptions for location and small belts.)	☐	☐
	Is exposed power shafting adequately guarded? (See 1910.219 for exemptions for locations.)	☐	☐

Based on the publication OSHA CHECK LIST prepared by Warner Insurance, Loss Prevention Dept., Chicago.

APPENDIX D

TUSC GENERAL AVIATION NEWS LETTER

The TUSC News

GENERAL AVIATION - TECHNICAL EDITION

Published by TECHNOLOGY USE STUDIES CENTER
Southeastern State College, Durant, Oklahoma 74701
(405) 924-0121 Extension 2517

SPONSORED BY THE TECHNOLOGY UTILIZATION DIVISION, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONTRACT NASW 2512 .

September 1, 1973

Gentlemen:

The task of putting a man on the moon during the decade of the Sixties absorbed most of the resources of NASA during that period. The capabilities of the National Advisory Committee for Aeronautics (NACA) was absorbed into NASA, the successor to NACA, and these capabilities were likewise devoted to the moon landing task.

With the opening of the decade of the Seventies, NASA surveyed the needs for research in general aviation and allocated resources to the research indicated.

Research results are now becoming available. The research results following WWII provided a lead for the American-built, transport-type aircraft; perhaps the NASA effort now being devoted to light, general-type aircraft can enhance our lead in this type vehicle.

We have been examining the feasibility of providing a source of information concerning the results of the research mentioned above--especially that which concerns general aviation. The technical level of the information we have in mind is probably not suitable (nor of wide enough interest) for general press releases. On the other hand, the technical level would not be typical of aeronautical engineering data--it would be readable and understandable to those in, or concerned with, general aviation.

The total NASA data bank now contains more than three-quarters of a million items of information; moreover, it is increasing at a rate of about 6,000 research topics per month. This data bank, as well as the new information added to it, will be reviewed and selected items summarized for information of special interest to those who support and participate in general aviation.

Volume I, Number 1, of the General Aviation Technical News Letter is attached. "Composites" are discussed at some length in this initial

letter; subjects to be discussed in a like manner in succeeding letters include: Head-Up Instrument Systems, Supercritical Wing, Fly-by-wire, Satellite Navigation, etc. Send your name, address, and occupation to the address included in the letterhead on page one if you would care to receive these publications. They will be provided without cost to you under NASA Contract Number NASW-2512.

An indication of the subjects you would like to see covered in these letters would be appreciated.

Sincerely,

A. M. Moore
Editor

AMM:vd

Attachment

The TUSC News

GENERAL AVIATION - TECHNICAL EDITION

Published by TECHNOLOGY USE STUDIES CENTER
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Volume I, Number 1 September 1, 1973

COMPOSITES

Many advancements made in aerospace have been closely associated with the progress made in metallurgy. Basically, metallurgy is that branch of science which deals with the separation of metals from the ore and prepares the metal for use. Many metallurgists believe that a point of diminishing returns has been reached in alloys for structural members and for hot environment applications.

"Composites" have received a great deal of attention from the metallurgists since Sputnik. These scientists have experimented with varying combinations of man-made fibers, ceramics, plastics, metals and metal alloys, seeking a combination that would exhibit an increase in strength-to-weight ratio and a tolerance for high temperature.

Development of man-made fibers has presented a promise for better aerospace materials. The fibers, sometimes called "whiskers," are not to be confused with the man-made fibers used in the textile industry. Fibers can be "grown" from silicate, iron, carbon, graphite and many other metals and semi-metals. They can be grown in lengths measured in feet and in diameter from submicron (less than a millionth of an inch) up to several microns. In short lengths and in bulk, they appear as a powder to the naked eye. The high degree of crystal perfection and orientation are believed to be the source of their great strength. Some of the more promising composites use these fibers for reinforcement similar to the use of steel for reinforcing concrete.

The bulk form of graphite has tensile strength of approximately 2,000 pounds per square inch while the fibers from graphite have a tensile strength of about 3½ million PSI.[1] Alumina has a bulk strength of 30,000 PSI and fibers from the same material have 2,200,000 PSI. Some fibers retain 80% of their strength at 3500°F[2]--in comparison, stainless steel melts at approximately 2700°F.

Manufacturing and fabricating structural shapes from composites has been and continues to be a great problem. How does one machine a composite material that is reinforced with fibers which have a tensile

strength of 3½ million PSI? Rolls-Royce Ltd. believed that it had found a way to fabricate turbine blades from a composite. Rolls originally sold the RB.211 engine with carbon fiber composite blades to Lockheed for its L-1011 transport. The composite blades would not retain their integrity under engine test and Rolls declared bankruptcy while trying to improve its manufacturing technique so that the blades would meet the specifications. Lockheed then ran into difficulty when it found itself with a ramp full of expensive, engineless airframes which were not saleable.

Experimental composite parts have been in use for some time on late military aircraft. Secondary structural parts, farings and skin sections are compiling an acceptable history for composites to date. The parts are largely "one-of-a-kind" and laboriously made, due to the primitive methods employed in fabricating the material.

Limited use of the fibers has not promoted the expenditure of funds necessary for the equipment to mass produce the material. The high cost of the "pilot plant" output imposes constraints upon the designing for use of the fibers. This situation in the introduction of new material is not unique. Aluminum cost $545.00 per pound in 1859. With the development of smelting knowledge and fabricating know-how mass production has brought the price down to approximately $.30 per pound. Requirements for lightweight, yet strong and temperature-tolerant structures in the NASA Shuttle program may provide the impetus for further development in usage of composites in general aircraft. It is believed that an increase in performance, a longer life span and a savings in maintenance will result from the employment of this new material in aircraft.

SUPERCRITICAL WING

When a situation is described as critical, immediate remedial action is in order. If the situation is SUPERCRITICAL, one would normally expect that catastrophic events were imminent. However, when aerodynamics is the subject under discussion, the definition of SUPERCRITICAL is changed considerably. The SUPERCRITICAL wing is proving in flight what it promised in the windtunnel. Aeronautical engineers expect that the supercritical airfoil will provide significant improvements in the performance of the next generation of transport aircraft. General aviation aircraft will probably reap benefits from this aerodynamic advancement during this decade. SUPERCRITICAL airfoils will be a subject discussed in one of the Fall letters of this series.

HEAD-UP INSTRUMENT DISPLAY

Head-up instrument display systems have received considerable attention recently. Giles Lay and Jack Tucker are trying to adapt the system for use in automobile driver education for the Oklahoma School of the Deaf, Sulphur, Oklahoma. An explanation of the head-up system will appear in a later issue of this letter.

FLY BY WIRE

"Fly-by-wire" systems which do away with bellcranks, push-pull rods and cables for moving flight control surfaces are coming closer to application to general aircraft. There is a significant weight-saving between small electrical leads going to actuators and all of the mechanical rods, etc. "Fly-by-wire" technology will be discussed in detail in one of the Fall editions of this letter.

METRIC SYSTEM CONVERSION CHART

NASA and many other technically orientated organizations have adapted the SI (metric) system of weights and measures. It appears that the system may be adapted by all segments of aerospace over the next decade or so. A chart is attached which might be useful as a reference on the change-over. The chart was developed by the Small Business Administration.

STUDY OF AIRCRAFT IN SHORT HAUL TRANSPORTATION SYSTEMS.
(N67-38582, 225 pages, $3.00, NTIS)

The Boeing Company contract study for NASA dated 1967 suggests that among other improvements in aircraft these major improvements from current levels are postulated by 1985:

> Profile drag reduced by 10%, placard speed increased by 20% with same comfort level, usable lift coefficient for STOL approach increased by 100%, powerplant weight reduced by 30-50%, increase of avionics reliability 2,000 fold.

Further on in the report they say, "Based on extrapolation of statistical information, an engine thrust-to-weight ratio of 40:1 can be expected by 1980." (Lift engine)

CHEMICALLY INDUCED IGNITION IN AIRCRAFT AND SPACECRAFT ELECTRICAL CIRCUITRY BY GLYCOL/WATER SOLUTION.
(TN D-4327, 15 pages, $1.50, TUSC)

Some old-time armament types think they know why JATO systems malfunctioned even AFTER thorough cleaning with a glycol cleaner.

NASA found, as reported in the above Technical Note, that silver-coated copper wire will ignite if exposed to glycol/water solutions. In the third reported experiment, "The first drop of solution (water/glycol) in both instances produced ignition in less than one minute with a sustained current flow." Glycol will cause stray current in an electrical system which has silver-coated wire. Anti-ice fluids and cleaning fluids containing glycol are not compatable with commonly used silver-coated, electrical aircraft wiring.

OPTIMUM RUNWAY ORIENTATION RELATIVE TO CROSSWINDS.
(N72-30250, 19 pages, $1.90, TUSC)

If you are planning an airport or modifying an existing facility, the above numbered report may be helpful. The abstract of the report contains this statement, "Two procedures for obtaining the optimum runway orientation relative to minimizing a specific crosswind speed are described and illustrated with examples. The empirical procedure requires only hand calculations on an ordinary windrose."

THE EFFECT OF VARIATIONS IN LOCAL GRAVITY AND OF AIRCRAFT SPEED ON THE EFFECTIVE WEIGHT OF AIRCRAFT IN HIGH PERFORMANCE CRUISE.
(N72-31024, 16 pages, $1.60, TUSC)

This report states, "For Concorde in cruise there is a reduction in effective weight of approximately 0.5% in westward flight and this increases to more than 2% in eastbound flight." (Let's quit talking about the maneuver used by a fly to light on the ceiling and talk about this one for awhile.)

SERVICE TO SMALL COMMUNITIES.
(Part 1, 114 pages, deals with local service carrier costs and subsidy need requirements; Part 2, 150 pages, Small Aircraft and Small Communities: A History and Economic Analysis)

Both of these reports were developed by the Civil Aeronautics Board. N72-31016 costs $7.75 for hard copy and N72-31017 costs $9.50 for hard copy. Each report is on microfiche for $0.95 each. NTIS.

SATELLITE AIR NAVIGATION And Other Systems.

The NEWNAV Symposium was held in Frankfort am Main, Germany, Oct. 5-7, 1971, and sponsored by the International Federation of Airline Pilots' Associations. Twenty-three reports eminated from this meeting. The reports cover: Satellite Navigations Systems, Doppler Systems, Area Coverage Nav Systems, Characteristics and Prospects for a New Landing Guidance System, Aircraft Collision Avoidance Systems, and similar subjects. TUSC can provide abstracts of all of the titles. The reports come from Frankfort am Main, Vereinigung.

REMOVAL OF BAKED-ON ALUMINIZED SILICONE PAINT. (from R1820 engines)

N72-31174, 11 pages, TUSC. A safe and practical method for removing baked-on aluminized silicone engine paint is outlined in this report.

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[1]NASA SP-5060, SOME NEW MATERIAL AND METAL-CERAMIC COMPOSITES, p.13.

[2]NASA SP-5055, NON-GLASSY INORGANIC FIBERS AND COMPOSITES, Table I, p. 14.

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CONTRACT NASW 2512

Volume I, Number 1 -5- September 1, 1973

Comparing the Commonest Measurement Units

Approximate conversions from customary to metric and vice versa.

	When you know:	You can find:	If you multiply by:
LENGTH	inches	millimeters	25
	feet	centimeters	30
	yards	meters	0.9
	miles	kilometers	1.6
	millimeters	inches	0.04
	centimeters	inches	0.4
	meters	yards	1.1
	kilometers	miles	0.6
AREA	square inches	square centimeters	6.5
	square feet	square meters	0.09
	square yards	square meters	0.8
	square miles	square kilometers	2.6
	acres	square hectometers (hectares)	0.4
	square centimeters	square inches	0.16
	square meters	square yards	1.2
	square kilometers	square miles	0.4
	square hectometers (hectares)	acres	2.5
MASS	ounces	grams	28
	pounds	kilograms	0.45
	short tons	megagrams (metric tons)	0.9
	grams	ounces	0.035
	kilograms	pounds	2.2
	megagrams (metric tons)	short tons	1.1
LIQUID VOLUME	ounces	milliliters	30
	pints	liters	0.47
	quarts	liters	0.95
	gallons	liters	3.8
	milliliters	ounces	0.034
	liters	pints	2.1
	liters	quarts	1.06
	liters	gallons	0.26

THESE PREFIXES MAY BE APPLIED TO ALL SI UNITS

Multiples and submultiples	Prefixes	Symbols
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
*1 000 000 = 10^{6}	mega	M
*1000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10	deka	da
0.1 = 10^{-1}	deci	d
*0.01 = 10^{-2}	centi	c
*0.001 = 10^{-3}	milli	m
*0.000 001 = 10^{-6}	micro	μ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

*Most commonly used